

Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (previously presented): A method of making a hollow, reinforced pressure vessel, comprising the steps of:

cutting thermoplastic fibers to form a plurality of discrete thermoplastic fibers;

forming a hollow preform comprised of a cylindrical sidewall portion, a domed bottom portion, and a domed top portion, wherein at least one of said portions is comprised substantially of a plurality of discrete reinforcing fibers separate from, and intimately intermixed with, said plurality of discrete thermoplastic fibers, wherein said intermixed fibers maintain a shape of said at least one of said portions; providing a rigid mold having a cylindrical sidewall portion and domed end portions corresponding to said preform portions;

positioning said preform against the inner surface of said corresponding mold portions;

compressing said preform with an internally pressurized, inflatable core that had been previously inserted within said preform to hold said preform in place;

heating said preform to a temperature sufficient to melt said thermoplastic fibers while the pressure in said

inflatable core compresses said preform and distributes thermoplastic material from said thermoplastic fibers throughout said preform to provide a fiber reinforced molded article;

cooling said molded article until said thermoplastic material is substantially solid;

reducing the pressure in said inflatable core; and

removing said molded article from said mold.

Claim 2 (previously presented): The method of claim 1 wherein the pressure in said inflatable core is increased during the heating step to compress said preform and maintain the distribution of thermoplastic material throughout said preform, whereby voids in the fiber reinforced molded article may be further reduced.

Claim 3 (original): The method of claim 1 wherein said hollow preform comprises a separately preformed sidewall portion and integrated bottom portion and a separately preformed top dome portion.

Claim 4 (original): The method of claim 1 wherein said hollow perform comprises a separately preformed cylindrical sidewall portion and comprises separately preformed domed portions.

Claim 5 (previously presented): The method of claim 4 wherein the separately preformed domed portions are comprised of filament wound isotenoid portions.

Claim 6 (original): The method of claim 5 wherein the sidewall portions overlap the domed portions.

Claim 7 (previously presented): The method of claim 4 wherein said cylindrical sidewall portion is formed from a rectangular blanket of reinforcing fibers intimately intermixed with thermoplastic material, said blanket being positioned against said cylindrical sidewall portion of the mold with a slight overlap of opposite ends of said blanket.

Claim 8 (original): The method of claim 1 wherein the ratio of reinforcing fiber to thermoplastic material is substantially constant throughout said preform.

Claim 9 (original): The method of claim 8 wherein said ratio is approximately 3:2.

Claim 10 (previously presented): The method of claim 1 wherein the ratio of reinforcing fiber to thermoplastic material varies within said preform.

Claim 11 (original): The method of claim 1 wherein the wall thickness of said preform is substantially constant.

Claim 12 (original): The method of claim 1 wherein the wall thickness of said preform varies along its length.

Claim 13 (original): The method of claim 1 wherein said reinforcing fibers are glass fibers.

Claim 14 (original): The method of claim 13 wherein said glass fibers are approximately 1 inch in length.

Claim 15 (original): The method of claim 1 wherein said thermoplastic material is chosen from the group comprised of: polypropylene, polyethylene, polybutylene terephthalate, polyethylene terephthalate, and nylon.

Claim 16 (original): The method of claim 1 further comprising, prior to said compressing, the step of treating the outer surface of said inflatable core with an adhesive agent so that said core is bonded to the interior of said molded article.

Claim 17 (original): The method of claim 1 further comprising, prior to said compressing, the steps of:
treating a surface of one of the top and bottom dome portions and an adjacent sidewall portion of said

inflatable core with an adhesive agent to provide an adhesive coated portion; and

treating a surface of another of said top and bottom dome portions and an adjacent sidewall portion with a releasing agent to provide a release coated portion; and, after said removing, the step of:

disengaging the release coated portion of said inflatable core from an inner surface of said molded article while the adhesive coated portion remains adhered to an inner surface of said molded article.

Claim 18 (original): The method of claim 1 further comprising, prior to said compressing, the step of treating the outer surface of said inflatable core with a releasing agent; and, after removing said molded article from the mold, the step of removing said inflatable core from said molded article.

Claim 19 (original): The method of claim 1 wherein said temperature is approximately 400 ° F and maintaining said temperature for a period of at least approximately 30 minutes.

Claim 20 (original): The method of claim 2 wherein said pressure is increased to approximately 2530 psi.

Claims 21-23 (canceled)

Claim 24 (original): The method of claim 1 wherein said inflatable core is a neoprene bladder.

Claim 25 (original): The method of claim 1 further comprising the step of connecting said mold to a source of vacuum during the heating step to further reduce the incidence of voids in the finished article.

Claim 26 (original): The method of claim 2 further comprising the step of connecting said mold to a source of vacuum during the heating step to further reduce the incidence of voids in the finished article.

Claim 27 (previously presented): A method of making a hollow, reinforced pressure vessel, comprising the steps of:

forming and assembling a hollow preform comprised of a cylindrical sidewall portion, a domed bottom portion, and a domed top portion, said forming and assembling including the steps of:

providing a plurality of discrete reinforcing fibers;
providing a plurality of discrete cut thermoplastic fibers; and

forming at least one of said cylindrical sidewall portion, domed bottom portion, and domed top portion by collecting said plurality of discrete reinforcing fibers

and said plurality of discrete thermoplastic fibers onto a vacuum screen to form said one or more portions, wherein said plurality of fibers substantially maintain a shape of said at least one portion;

assembling a hollow liner along with said portions to into an assembled preform, said liner having a cylindrical sidewall portion, a domed bottom portion, and a domed top portion;

providing a rigid mold having a cylindrical sidewall portion and domed end portions corresponding to said preform portions;

positioning said assembled preform against the inner surface of said corresponding mold portions;

heating said assembled preform sufficient to melt said thermoplastic fibers and distribute thermoplastic material from the thermoplastic fibers throughout said assembled preform to provide a fiber reinforced molded article;

cooling said molded article until said thermoplastic material is substantially solid; and

removing said molded article from said mold.

Claim 28 (previously presented): The method of claim 27 wherein said liner is a thermoplastic liner.

Claim 29 (previously presented): The method of claim 27 further comprising, during said heating, the step of pressurizing the liner with a gas or a fluid; and prior to

removing said molded article from the mold, the step of reducing the pressure in said plastic liner.

Claim 30 (original): The method of claim 29 further comprising, during said heating, the step of connecting said mold to a source of vacuum during the pressurizing step to further reduce the incidence of voids in the finished article.

Claim 31 (previously presented): A method of making a hollow, reinforced pressure vessel, comprising the steps of:

- a) providing:
 - i) a hollow preform of glass reinforcing fibers approximately one inch long intimately intermixed with separate thermoplastic fibers approximately two inches long, wherein the ratio of glass fibers to resin fibers is approximately 3:2 uniformly throughout said preform, said preform having a cylindrical sidewall portion, a domed bottom portion, and a domed top portion, and
 - ii) a rigid mold having a cylindrical sidewall portion and domed end portions corresponding to said preform portions;
- b) positioning said preform against the inner surface of said corresponding mold portions;
- c) compressing said preform with an internally pressurized, flexible inflatable core inserted within said

preform and having a cylindrical sidewall portion, and top and bottom dome portions to hold said preform in place;

d) heating said preform to approximately 400 degrees F while maintaining that temperature for between 20 and 60 minutes, while also increasing the pressure in said inflatable core to approximately 25-30 psi to compress said preform and distribute the thermoplastic material throughout said preform to provide a substantially void free fiber reinforced molded article;

e) cooling said molded article until said thermoplastic material is substantially solid;

f) reducing the pressure in said inflatable core;

g) removing said molded article from said mold; and

h) removing said inflatable core from the molded article.

Claim 32 (previously presented): The method of claim 31 further comprising the step of connecting said mold to a source of vacuum during said heating to further reduce the incidence of voids in the finished article.

Claims 33-34 (canceled)

Claim 35 (previously presented): A method of making hollow, reinforced plastic composite articles, comprising the steps of:

a) providing, without a prior winding step:

i) a hollow preform comprised of a plurality of discrete reinforcing fibers intimately intermixed with a thermoplastic material, said preform having a cylindrical sidewall portion, a domed bottom portion, and a domed top portion, and

ii) a rigid mold having a cylindrical sidewall portion and domed end portions corresponding to said preform portions;

b) positioning said preform against the inner surface of said corresponding mold portions;

c) compressing said preform with an internally pressurized, inflatable core inserted within said preform to hold said preform in place;

d) heating said preform to a temperature sufficient to melt said thermoplastic material while the pressure in said inflatable core compresses said preform and distributes the thermoplastic material throughout said preform to provide a fiber reinforced molded article;

e) cooling said molded article until said thermoplastic material is substantially solid;

f) reducing the pressure in said inflatable core; and

g) removing said molded article from said mold.

Claim 36 (currently amended): A method of making hollow, reinforced plastic composite articles, comprising the steps of:

- a) providing:
 - i) an assembled preform including a cylindrical sidewall portion, a domed bottom portion, and a discrete domed top portion;
 - ii) a rigid mold having a cylindrical sidewall portion and domed end portions corresponding to said preform portions; and
 - iii) a flexible, inflatable core;
- b) positioning said core within said preform and placing said cylindrical sidewall portion, said domed bottom portion, and said discrete domed top portion against the inner surface of said corresponding mold portions to form an assembled preform having said core inserted into an interior of said assembled preform;
- c) inflating said core for compressing and pressurizing said assembled preform to hold said assembled preform in place;
- d) heating and pressurizing said assembled preform for a period of time to compress said assembled preform and distribute ~~the~~ thermoplastic material throughout said assembled preform to provide a substantially void free fiber reinforced molded article;
- e) cooling said molded article until said thermoplastic material is substantially solid;
- f) reducing the pressure in said inflatable core;
- g) removing said molded article from said mold; and

h) removing said inflatable core from the molded article.

Claim 37 (previously presented): The method of claim 36, wherein at least one of said cylindrical sidewall portion, said domed bottom portion, and said discrete domed top portion are comprised of a plurality of discrete reinforcing fibers intimately intermixed with a plurality of discrete thermoplastic fibers.

Claim 38 (previously presented) A method of making a hollow, reinforced pressure vessel, comprising the steps of:

cutting thermoplastic fibers to form a plurality of discrete cut thermoplastic fibers;

forming a hollow preform comprised of a cylindrical sidewall portion, a domed bottom portion, and a domed top portion, said forming including the steps of:

providing a plurality of discrete reinforcing fibers, and

forming at least one of said cylindrical sidewall portions, domed bottom portion, and said domed top portion by collecting said plurality of discrete reinforcing fibers and said plurality of discrete thermoplastic fibers onto a vacuum screen to form said one or more portions, wherein said plurality of fibers substantially maintain a shape of said portions;

providing a rigid mold having a cylindrical sidewall portion and domed end portions ;

positioning said portions against the inner surface of corresponding mold portions to assemble a preform; and

heating said assembled preform sufficient to melt said thermoplastic fibers and distribute thermoplastic material from the thermoplastic fibers throughout said preform to provide a fiber reinforced molded article.

Claim 39 (previously presented): The method of claim 38, further comprising the step of providing a hollow liner within said preform prior to said positioning step.

Claim 40 (previously presented): The method of claim 39 further comprising, during said heating, the step of pressurizing the liner with a gas or a fluid.

Claim 41 (previously presented): The method of claim 39 wherein said liner is a thermoplastic liner.

Claim 42 (previously presented): The method of claim 38 further comprising, during said heating, the step of connecting said mold to a source of vacuum during the pressurizing step to further reduce the incidence of voids in the finished article.

Claim 43 (canceled).

Claim 44 (previously presented): A method of making a hollow, reinforced plastic composite article, said method comprising the steps of:

providing a domed top portion comprising a matrix of reinforcing fibers and a thermoplastic material, said matrix including a plurality of randomly positioned discrete short individual fibers;

assembling a preform including said domed top portion and a reinforcing mat wrapped to form a cylindrical sidewall portion of said preform;

providing a rigid mold adapted for receiving said preform; and

positioning said preform in said mold with an inflatable core inserted within said preform;

pressurizing said core by connecting said core, inserted within said preform, to a source of pressurized fluid;

heating said preform with said pressurized core, within said mold, to compress said assembled preform and thereby melt and distribute said thermoplastic material throughout said preform to provide a substantially void free fiber reinforced molded article;

reducing the pressure in said core; and

removing said molded article from said mold.

Claim 45 (previously presented) The method of claim 44, further comprising the step of removing said core from said molded article prior to using said molded article.